Original Research Article

Effect of box breathing technique on lung function test

Running title: Box breathing technique on lung function test

ABSTRACT:

Background: Box breathing exercise is a technique of slow breathing rhythm also known as square breathing used universally. It increases the performance and concentration level, it also acts as a powerful stress relief. It is tested with a spirometer for the lung function test that measures the airflow of the upper and lower respiratory tract. This method builds up carbon dioxide in blood which calms down and regulates the ANS (Autonomic Nervous System), which enhances the cardio- inhibitory response of the vagus nerve that improves the mood. The main aim of the study was to analyze the effect of box breathing technique on lung function

Materials and methods: The present study was carried out among the participants at the age of 18-25 years from Saveetha Dental College. A total of 30 participants were included in this study (15 males, 15 females). The experimental training procedures consisted of 2 sessions of box breathing day and night for a period of 30 days. Participants were informed of the procedures of the box breathing technique. RMS Helios spirometer was used to measure lung volumes and capacities. Statistics analysis was done using SPSS software, paired t test. *P* value of less than or equal to 0.05 was considered significant statistically.

Result: There was a significant increase among the participants FVC (Forced Vital Capacity), FEV1 (Forced Expiratory Volume), FIVC (Forced Inspiratory Vital Capacity) parameters after 2 sessions on each day of box breathing technique for a period of 30 days. Other parameters increased to 10% but not significantly.

Conclusion: The present study illustrates the potential for box breathing practice to improve lung performance and reduce stress in healthy individuals. Despite the significant difference in

FVC, FEV, FIVC levels supporting improved lung function, further investigation is needed to delineate mechanisms that underlie these benefits

Keywords: Breathing exercise, Spirometer, FVC, FEV1, FIVC, Innovative techniques

INTRODUCTION:

Box breathing is a technique of slow breathing rhythm which is widely used by athletes and professional workers. It is also known as the four square breathing. It is simple to practice; it involves 4 steps that are inhaling for 4 seconds, holding the breath for 4 seconds, exhaling for 4 seconds, holding the breath for 4 seconds. Then repeat this session. This technique heightens performance and concentration; it also acts as a powerful stress relief. It is beneficial to all types of people especially the ones suffering from certain lung diseases and smokers (1).

According to the Mayo clinic, there is evidence that this technique can actually regulate and calm down the ANS (Autonomic Nervous System). It can lower the blood pressure and give an immediate sense of calm, it regulates the body temperature. The slow breathing rhythm allows to build CO2 in the blood, which enhances the cardio-inhibitory response of the vagus nerve and stimulates the parasympathetic system when exhaled (2). This technique can reduce stress and improve the mood, which indirectly helps in conditions such as GAD (Generalized Anxiety Disorder), Panic disorder, Post-Traumatic Stress Disorder (PTSD), and depression. Psychological studies have revealed that box breathing can be an effective intervention for emotion enhancement (3). Further evidence from a randomized control trial showed that this breathing exercise reduced depression and anxiety in patients with chronic lower back pain (4). Cardiopulmonary function is an important factor for lung capacity, pulmonary ventilation and strengthens the respiratory tract by reducing respiratory fatigue (5). Reduced cardiopulmonary fitness has significant effects among the elderly people, through physical and sarcopenia

disability due to aging (6). Some researchers believe that the relaxation generated due to this technique helped to manage attention symptoms among children with ADHD (Attention Deficit-Hyperactivity disorder (7). Plasma cortisol levels reflect changes in the activation of the HPA axis with changes in CO2 inhalation (7,8).

The lung function tests were carried out by an instrument called the RMS helios spirometer. It measures the airflow with parameters such as FVC, FEV1, FEV1/FVC, FEF 25-75, PEFR, FIVC. It can also evaluate lung diseases by measuring the amount of air inhale and exhale quickly. There are three phases in this procedure: 1) Maximal inspiration, 2) A quick exhalation, 3) Continued complete exhalation till the end of the test. An obstructive ventilatory defect with low DLCO suggests lymphangiomyomatosis (9). Most cross-sectional studies have shown that this breathing technique benefits individuals such as women during pregnancy (10). Cognitive tests were used to measure the mental benefits, cortisol, a HPA axis related to stress hormone in humans, were measured to examine whether this technique could be a buffer for modulating stress levels in a working population (11).

Our team has extensive knowledge and research experience that has translated into high quality publications(12–14)(15–20),(21)(22),(23)(24),(25)(26)(27–31).

The aim of this study is to estimate the effect of box breathing technique on FVC, FEV and FIVC

MATERIALS AND METHOD:

Participants: The study participants were recruited from Saveetha Dental College,Chennai. The study was approved by the Institute review board. Before initiating the work, the study was fully explained to the participants, and informed written consent was obtained from each participant. All participants were healthy dental students, and completed the following screening forms 1) A health approval from a recent physical check-up at a medical centre and 2) A demographic questionnaire that included basic demographic information. Participants who had a history of health problems were excluded.

Experiment protocol: All interventions and tests were performed in the laboratory. Participants sat comfortably throughout the study and were instructed how to do the box breathing technique. A final total of 30 participants were included in this study (15 males, 15 females), gender balance was also taken into consideration. The lung function test was taken with an instrument called the 'RMS helios spirometer'.

The lung function test was first taken to all participants and recorded the FVC, FEV1, FEV1/FVC, FEF 25-75, PEFR, FIVC parameters. The experimental training procedures consisted of 2 sessions of box breathing day and night for a period of 30 days. Participants were informed of the procedures of the box breathing technique. 1) They were required to inhale for 4 seconds, 2) Hold the breath for 4 seconds, 3) They were required to exhale for 4 seconds, 4) Hold the breath for 4 seconds. Each participant was monitored and recorded by the spirometer after 30 days for a total of 60 sessions of box breathing daily consisting of practice of 20 times per session.

Statistical analysis:

The data were analysed statistically using SPSS. Paired t-test was used to analyze the statistical significance between groups. The levels of significance were considered at the levels of $p<0.05$.

RESULT:

Demographic characteristics of all the participants in each group are summarized in the table. The paired t-tests showed that there were group differences in terms of age, years of education. There was a significant increase among the participants FVC, FEV1, FIVC parameters after 2 sessions on each day of box breathing technique for a period of 30 days. Other parameters increased to 10% but not significantly (Figure 1, Figure 2).

Parameters	**Pre**	**Post**	**P.value**	**Significance**
FVC	2.30±0.69	2.48±0.71	0.001*	Significant
FEV1	1.98±0.75	2.16±0.71	0.000*	Significant
FEV1/FVC	82.40±21.92	81.79±21.20	0.741	Not significant

FEF 25-75	2.39±1.74	2.48±1.12	0.505	Not significant
PEFR	2.89±1.74	2.94±1.40	0.708	Not significant
FIVC	1.89±0.82	2.07±0.86	0.011*	Significant

Table 1: Standard deviation and mean of the lung parameters of pre and post box breathing technique and its levels of significance. * represents statistically significant ($p<0.05$)

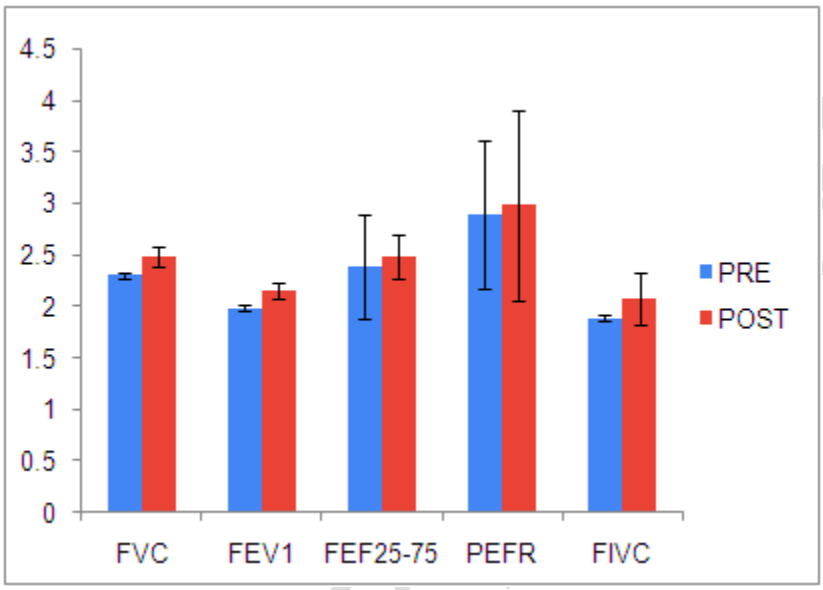

Figure 1: Bar graph represents the pre and post values of the box breathing parameters. X axis represents the lung parameters, Y axis represents the values. Blue represents pre values and red represents post values.The levels of significance were considered at the levels of $p<0.05$. FVC, FEV1 and FIVC levels were significantly higher post box breathing technique

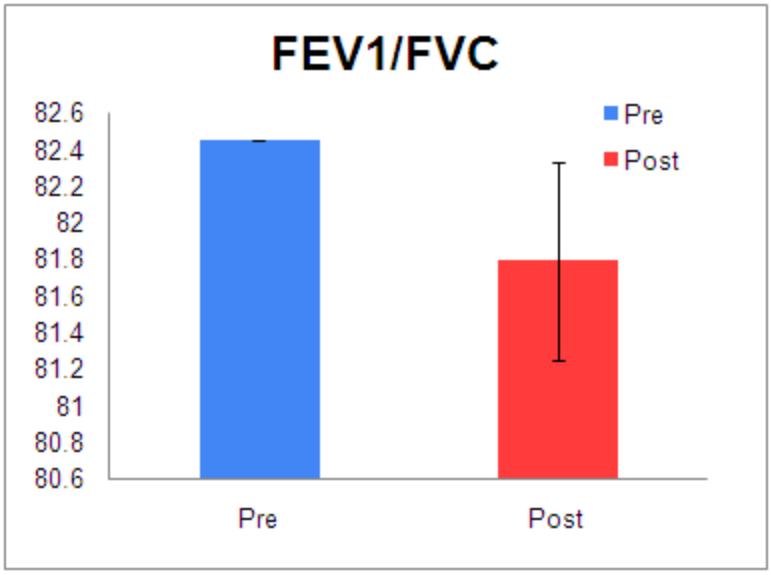

Figure 2: It represents the pre and post values of the FEV1/FVC parameter. X axis represents the pre and post values of the lung parameter, Y axis represents the values. Blue represents pre values and red represents post values. The levels of significance were considered at the levels of $p<0.05$. FEV1/FVC level was not significantly higher post box breathing technique

DISCUSSION:

After balloon blowing exercise, FVC, FEV1/FVC, and PEFR were significantly raised at the end of 4th week but it decreased at the end of 6th week. FEV1 and VC showed different output i.e. significantly raised at the end of 4th week but no change observed at the end of 6th week. An earlier study was carried out on aged stroke patients, lung treatment was given for four weeks and they observed increases in FVC values (32). Another study was carried out previously that evaluated the effect of controlled race breathing, significant increases of FVC and FEV values were observed by the end of 4th week (33). The results were similar to the present findings. The present study examined whether 30 days of intensive box breathing technique could influence lung function. There was a significant increase in the FVC, FEV1 and FIVC levels (shown in table 1). However the FEV1/FVC, FEF 25-75, PEFR did not show significant differences as shown in figure 2 but it did increase by 10%, surely the post values would have increased more if it was practiced for a longer period of time. We interpret the findings as illustrating the potential benefits of box breathing for improving the lung function.

Numerous studies in health physiology and clinical treatment have demonstrated that box breathing technique is an effective relaxation technique (34). In a study, slow breathing rate was observed on chronic heart failure (35).

The present study confirms the results of previous studies, analysis that indicated low PPV and high NPV for FVC and FEV1 in predicting a restrictive ventilatory defect (36) validity of spirometric algorithms using FVC and FEV for 6 seconds for predicting a reducing total lung capacity (37). A spirometry-based algorithm to direct lung function testing in the pulmonary function laboratory.

Limitations of this study were the less number of sample sizes and less time period for carrying out the experiment. If the experiment was carried for a longer period of time there would have been a significant increase in all the parameters and given a more precise statistical view of sample size were more in number.

CONCLUSION:

The present study illustrates the potential for box breathing practice to improve lung performance and reduce stress in healthy adults. Despite the significant difference in FVC, FEV1, FIVC levels supporting improved lung function, further investigation is needed to delineate mechanisms that underlie these benefits.

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